

drought during the month; Anna, on the 11th, relieved by subsequent rains. Massachusetts—Waltham, drought towards end of month. Texas—Clarksville, drought during month injurious to cotton and late corn; Deason, corn, cotton and vegetables suffering greatly; Pilot Point, 16th, vegetation drying up for want of rain, relieved by heavy thunder-storm on the 18th. Virginia—Wytheville, drought ended on the 16th. Iowa—Ndm Springs, latter part of month corn and potatoes suffering. Wisconsin—Waupesa, during month wells failing, brooks drying up, swamps dry, crops damaged; hay, half crop; wheat and oats, half to three-quarters of a crop; potatoes, small amount, no wild fruits, no apples. Dakota—Olive, 15th. Ohio—Cleveland, 9th.

*Hail-storms.*—Hail-storms have been reported as follows: 1st, Kan., Conn., Md., N. Y., N. J., Ill.; Dak., Pa.; 2nd, Va., N. C., Ill., Kan.; 3rd, Del., N. Y., Pa.; 5th, N. Y., Fla., Ind., N. J., Ohio, Vt., Va., Ga., Dak., Pa., Pembina, D. T.; 7th, Mich.; 8th, Wyoming Tër., Iowa, N. M.; 9th, Conn.; 10th, Wy. Tër., Me., Ind.; 11th, Texas; 13th, N. J., N. M.; 15th, N. C.; 17th, Kans.; 21st, Col.; 22nd, Va., N. M.; 24th, Wy. Tër.; 25th, Col.; 26th, Col., Md., Dak.; 27th, Pa., Dak.; 28th, N. Y.; 29th, N. M.; 30th, N. Y., Dak.

*Largest hail-stones.*—1st, Conn., Southington, 1 inch in diameter; N. Y., Farmingdale, size of pigeon's eggs; N. J., Barnegat, 3 inches in circumference; Westown, stones  $\frac{1}{2}$  to 1 $\frac{1}{2}$  inches in diameter; path of storm, 1000 yards wide; course, N. E. by N.; depth of hail,  $\frac{1}{2}$  to 5 inches; destroyed all vegetable growth, killed one cow, several pigs and chickens, &c. 2nd, Ashfield, N. C., stones as large as pigeon's eggs. 3d, Florida, Mayport,  $\frac{1}{2}$  inch in diameter; N. Y., Adams, 2 $\frac{1}{2}$  inches in diameter. 5th, Ft. Rice, D. T., 3 inches in diameter; Ohio, Murristown, as large as hen's eggs. 7th, Mich., Marquette, one hail-stone measured nine inches in circumference—most were nearly egg-shaped. 6th, N. Y., Rodman, 9 inches in circumference. 13th, N. J., Atlantic City,  $\frac{1}{2}$  inch in diameter. 15th, N. C.; Greenville, as large as pigeon's eggs. 22nd, Santa Fe, as large as pigeon's eggs. 30th, on the Yellowstone, as large as a man's clenched hand, perforating the tepees of the Crow Indians and killing a large number of ponies; at Bismarck, stones as large as pigeon's eggs.

*Snow.*—The 4th, at Summit, Col., was celebrated by a snow-ball party, on snow shoes, which afterward resolved itself into a flower-gathering party, the situation admitting of persons standing on the snow three feet deep, and picking a large variety of Alpine flowers from the uncovered ground beyond the snow. On the 27th, 28th and 29th, snow fell at Pike's Peak.

*Rainy days.*—The number of days on which rain has fallen, as recorded by Signal Service observers, ranges as follows: New England, 10 to 20 days; Middle Atlantic, 13 to 18; South Atlantic, 9 to 14; East Gulf, 8 to 14; West Gulf, 7 to 13; Tennessee and Ohio valley, 10 to 18; Lower Missouri valley, 6 to 14; Upper Mississippi valley, 8 to 10; Upper Lake region, 10 to 18; Lower Lake region, 10 to 14; Rocky Mountain stations, 1 to 19; California, 0 to 1; Oregon, 5.

*Cloudy days.*—The number of cloudy days reported during the month by Voluntary Observers and Army Sergeants ranges about as follows: New England, 6 to 19 days; Middle Atlantic States, 5 to 20 days; South Atlantic States, 3 to 14 days; East Gulf States, 3 to 5 days; West Gulf States, 2 to 16 days; Tennessee and Ohio valley, 5 to 13 days; Lower Missouri valley, 2 to 23 days; Upper Mississippi valley, 2 to 6 days; Lake region, 2 to 22 days.

*Rain from a cloudless sky* was observed at Bangor, Me., on the 17th.

## RELATIVE HUMIDITY.

The average relative humidity for the month ranges about as follows: New England, 65 to 85; Middle Atlantic States, 58 to 86; South Atlantic States, 65 to 78; East Gulf States, 62 to 79; West Gulf States, 65 to 70; Tennessee and Ohio valley, 67 to 70; Lower Missouri valley, 62 to 68; Upper Mississippi valley, 62 to 68; Upper Lakes, 62 to 72; Lower Lakes, 61 to 70; San Diego, 74. High stations, uncorrected for altitude, report as follows: Mt. Washington, 86; North Platte, 47; Cheyenne, 31; Denver, 32.

## WINDS.

*In General.*—The prevailing winds at Signal Service stations are shown by arrows on chart No. II, from which it will be seen that southerly winds greatly predominated, tending to southeast west of the Mississippi; and to southwest along the Atlantic coast and Lake region.

*Total Movements.*—The largest total movements are as follows: Mt. Washington, 14,903 miles; Cape Lookout, 12,022; North Platte, 11,145; Pike's Peak, 11,090; Cape Hatteras, 10,176; Kittyhawk, 9,619; Breckenridge, 9,431.

*The Smallest Movements* are: Shreveport, 1,880; Nashville, 2,707; Augusta, 2,182; Lynchburg, 2,440.

*The Highest Velocities*, in miles per hour, have been: 1st, Sandy Hook, 73; 2nd, Pike's Peak, 50; 19th, Cape Lookout, 60; 25th, Mt. Washington, 65; 28th, Washington, D. C., 60; 30th, North Platte, 84 miles.

*Local storms, tornadoes, &c.*, have been reported, as follows: (unless specially noted, it is understood that the following list of high winds include only local storms, and not such gales as prevailed simultaneously over a large region:) 1st, Rochester, N. Y., reports considerable damage by storms to houses, fruit trees and standing grain; North Volney, N. Y., severe wind and hail-storms, doing much damage; Wappinger's Falls, N. Y., tornado, damaging buildings and blowing down trees; a severe wind-storm at Coatsville, Pa., during which a number of houses were destroyed; tornadoes at Ercildoun, Chester Co., and Parkersburg, Pa.; at Waverly, Johnson Co., near St. Paul; Jolly, Ind.; Richmond, Ky.; Gilsum and Sullivan, Chester Co., N. H.; terrific storm at Marlborough, N. Y., much damage done; heavy thunder-storm at Lawrenceville, Pa., damage \$30,000. 2nd, tornadoes at Kingsburg, Ind. A destructive tornado occurred at Elkhart, Indiana. It is stated that the day had been unusually warm with light breezes; about 4:30 p. m., there were two storms moving in nearly parallel paths to the east, one from the southwest, the other from the northwest. About 5:30 the upper stratum of air seemed agitated and the higher clouds moved from opposite directions towards each other; below were some ash colored clouds which flew from all directions towards a common centre. At this centre the tornado struck the ground with a black column of cloud about forty rods wide, demolishing everything in its path. It followed the bank of the St. Joseph river for nearly two miles, then lifted and sank again about two miles to the southeast, striking another stream. The centre of the tornado was over the river, as shown by the trees, buildings, etc., falling towards the south. Many persons in the path of the tornado noticed a smell of sulphur. Some say the odor was the same as in the battery room of a telegraph office. As is frequently the case, this tornado was followed by a very severe thunder-storm. This same evening, (2nd,) at 6 p. m., a tornado passed near Goshen, Ind., tearing down houses and trees, and killing several people. Goshen lies about ten miles southeast of Elkhart, and it was probably the same tornado that visited both places. During the 1st and 2nd Illinois, Indiana and Ohio were visited by an unusual number of tornadoes, destructive to life and property, occurring in advance (southeast quadrant) of depression chartered as No. II, on Map I of this Review. 3rd, tornadoes at Grantsville and Baltimore, Md., described as a very heavy storm, chimneys and trees blown down, wind must have reached 50 or 60 miles in elevated positions; damage to church \$1,000. Portsmouth, N. C., remarkable wind-squall, or whirlwind, at 3 p. m., driving sand blasts before it, uprooting trees, destroying fences and out-buildings, sucking water from all ponds, and being followed by thunder-storm. 5th, Butler Co., Ohio, tornado struck the ground in Liberty township, appearing to drop down from above in the form of a dense black cloud, bounding almost immediately, it struck again about a mile and a half distant in a southeasterly direction, uprooting trees, twisting off their trunks, demolishing houses and barns, destroying grain in the shock, growing corn, and sweeping away fences and orchards, disappeared beyond West Chester, near Pisgah. Severe tornado swept over Morrow Co., Ohio, path twelve miles long and one mile wide. Severe storm in southern part of Alleghany co., and a violent rain storm passed over Berks Co., Pa. Severe hail-storm at Charlottesville, Va. Jacksonsburg, Ohio, hurricane from WNW. to ESE., damaging buildings, crops and trees; as it passed through a forest thousands of small bolls were seen about 100 feet from the ground, giving out a pale flame. Wytheville, Va., hurricane twisted off, near the base, 6 forest trees (5 oaks and one walnut) from 1½ to 2 feet in diameter. Tybee Island, two miles west of station, at 5:35 p. m., waterspout bursted, making a whizzing noise, column about 100 feet high and 3 feet in diameter. Severe gale at Wautoma, Wis., unroofing buildings, uprooting trees and destroying crops. 6th, heavy gale at Fernandina, Fla. 7th, Breckenridge, Minn., wind blowing 90 miles per hour for about 3 minutes, unroofing and demolishing buildings, leveling fences, twisting off tree-trunks, &c., Pelham, N. Y., tornado, tearing trees up by the roots; much damage to orchards. 7th, a very destructive tornado occurred at Pensaukee, Wis. It moved from the northwest to southeast; its track was three miles long and one thousand feet wide; it lasted about two minutes; eight persons are known to have been killed; many were wounded; the damage to property was estimated at \$300,000. 9th, Westfield, Mass.—storm doing heavy damage, houses blown down, fences scattered, crops destroyed, and several lives reported lost. Tornado, with violent wind, rain and hail at Galt, Ont., at 5 a. m. 9th, and 27th, Poughkeepsie, N. Y., severe wind storms. 10th, New Orleans, La., at 6:55 p. m., a water-spout was observed apparently over the Lake, moving towards the NW., and followed by a heavy thunder-storm; Tybee Island, Ga., two water-spouts observed 4 miles north of station at 6 p. m.; they were about 1 mile apart, columns long and of short duration. 11th, Tybee Island, Ga., 8 miles NW. of station, in Jones' river, two water-spouts at 11 a. m., columns appeared nearly one mile high and about two feet in diameter, distance apart about four rods, and lasting about fifteen minutes; at Indianola, Tex., 7:35 a. m., water-spout formed in bay about two miles from shore, having an apparent diameter of seventy-five feet; travelled furiously for seven miles, and then broke, followed by rain at 7:35 a. m.; Savannah, Ga., waterspout observed a short distance south of the city in afternoon. 15th, Fort Whipple, Va., violent thunder-storms, lightning striking and shattering flag-staff. 16th, tornado in Dutchess and Cumberland counties, N. Y. 27th, severe gale with hail and rain at Richland Station, Pa.; heavy wind storm at Poughkeepsie, N. Y. 19th, tornado at Elizabeth, N. Y. 26th, Ft. Sully, Dak., a hurricane described as follows: at 5 p. m., a few cumulo-stratus clouds appeared in the horizon; at 5:30 cumulo-stratus were forming over the station, spreading rapidly in every direction; at 6 p. m., the sky was entirely

cove ed by swiftly moving clouds; at 6:20 the wind suddenly veered from SE. to W.; the wind blew in gust; and at 6:25 p. m. the anemometer, which previously registered 84 miles per hour, was torn from the roof, the chimneys quickly followed, and the building trembled like a leaf; the instrument shelter was blown down, as well as every board fence in and about the post; two houses were unroofed. The stockade, built of heavy timber and braced on both sides, was leveled to the ground, and one of the block-houses was moved eighteen inches; at 6:30 p. m. rain, hail and lightning commenced; at 7:40 p. m. the storm ceased. The highest wind was not registered; it was estimated at 100 miles per hour.

## VERIFICATIONS.

The detailed comparisons of the tri-daily weather indications, with the telegraphic weather reports for the succeeding twenty-four hours, shows a general percentage of omissions of 0.05 per cent., and of verifications of 84.1 per cent.; out of 3,702 predictions, 2,521, or 68.1 per cent. have been fully verified; 382, or 10.3 per cent. have been three-fourths verified; 547, or 14.8 per cent. have been one-half verified; 126, or 3.4 per cent. have been one-fourth verified and 126 or 3.4 per cent. have failed. The percentages for the four elements have been: weather, 89.1; wind, 81.8; temperature, 86.6; barometer, 78.8. The percentages of verifications by geographical districts, have been: New England, 84.5; Middle Atlantic States, 84.0; South Atlantic States, 82.1; East Gulf States, 81.9; West Gulf States, 85.6; Lower Lake region, 84.6; Upper Lake region, 82.9; Tennessee and Ohio valley, 84.4; Upper Mississippi valley, 86.4; Lower Missouri valley, 84.6.

*Cautionary Signals.*—During the month 29 Cautionary Signals have been displayed at stations on the Gulf and South Atlantic coasts and on the Lakes. Of these 23 or 79.3 per cent. were justified by subsequent high winds within one hundred miles of the stations for which they were ordered, and 6 or 20.7 per cent. were not justified so far as known. Eighty-four instances of high winds, where no signals were displayed, have also been reported from these stations. Telegraphic communication with the North Carolina coast stations has continued interrupted during the month.

## NAVIGATION.

*Stages of Water.*—In the table on chart No. III, are given the highest and lowest readings on the river gauges for the month. A gradual fall has occurred in all the rivers, throughout the month, with the following exceptions:—slight rises in the Missouri at Omaha, on the 8th, 15th and 16th; in the Mississippi at St. Paul, from the 1st to 8th; at La Crosse, to the 12th, and from Dubuque to St. Louis until about the 17th; in the Cumberland, at Nashville, from the 18th to the 20th; in the Ohio, at Pittsburgh, on the 5th, 10th and 11th, 19th to 21st, and 28th to 31st; at Cincinnati, from the 6th to the 11th, and the 24th to the 27th. at Louisville, from the 7th to the 11th, and the 25th to the 28th. The Savannah rose at Augusta on the 20th, 21st and 25th. The rise in the Missouri, at Omaha, on the 8th, was due to the water cutting a new channel across the bend and turning the main channel. On the 1st, the water in Lake Erie is reported to have risen several feet at Buffalo.

*Ice bergs.*—None reported.

## TEMPERATURE OF WATER.

*In General.*—The temperature of water, as observed in rivers and harbors, is shown in the table on chart No. II. The average temperatures have been lowest at Eastport, 43°; and at Marquette, 49°. They have been highest at Galveston and Augusta, 87°; Montgomery, 85°; Mobile, 86°; Charleston, Knoxville, Savannah and Wilmington, 84°.

*Maximum and Minimum Temperatures.*—The highest maxima have been: Galveston, 91°; Augusta, 90°; Montgomery and Mobile, 89°. The lowest minima have been: Eastport, 40°; Duluth, 43°; and Marquette, 46°.

*Ranges of Temperatures.* The least ranges have been: San Francisco, 2°; Savannah, 3°; Grand Haven and Wilmington, 4°; Charleston, Escanaba, Eastport and Mobile, 5°.

## ATMOSPHERIC ELECTRICITY.

*Thunder-storms* were reported at stations as follows: 1st. N. Y., R. I., Conn., Del., Ill., Iowa, Kan., Me., Md., Mass., Mo., Neb., N. H., N. J., Ohio, Penn., Vt., W. Va., Dak.; 2nd. Mich., Can., Ill., Ind., Iowa, Me., Mo., Neb., N. Y., Ohio, S. C., Va., Vt., Penn., Kan.; 3rd. N. Y., Va., Conn., Del., La., Md., Mich., N. J., N. C., Ohio, Penn., Ill., W. Va., Ind.; 4th. Ill., Ind., Mass., Minn., N. J., N. Y., Ohio, Texas, Va., Wis., Tenn., Ky.; 5th. N. Y., Can., Ga., Ill., Ind., Kan., Me., Md., Mass., Mich., N. J., N. C., Ohio, Penn., S. C.,